WHAT IS CLAIMED IS:

1. A carousel-type sputtering apparatus which is configured so that a drum, which is formed in a polygonal or circular shape in transverse cross-section, is provided so as to be rotatable in a chamber, the drum having substrate holders provided on an outer peripheral surface;

magnetron sputtering sources are provided inside a chamber wall;

each of the magnetron sputtering sources comprises a target and a magnetron unit for holding the target; and

the targets are held so as to be parallel with a rotary axis of the drum by the magnetron units;

the sputtering apparatus comprising:

a film thickness measuring instrument, which measures a thickness of a film deposited on a substrate mounted on a substrate holder during film deposition;

a power supply unit, which supplies the respective targets with power required for sputtering; and

a controller, which controls parameters affecting on an amount of film deposition, based on measurement results obtained by the film thickness measuring instrument.

2. The sputtering apparatus according to Claim 1, wherein each of the magnetron sputtering sources comprises an AC magnetron sputtering source and a magnetron sputtering source with a target mounted on a

single magnetron unit, and

the AC magnetron sputtering source having two adjacent targets provided thereon such that an anode/cathode relationship between the two targets is alternately changed by a frequency.

3. The sputtering apparatus according to Claim 2, wherein the controller makes such a control that rapid film deposition is performed by an AC magnetron sputtering source from start of film deposition, the film deposition by the AC magnetron sputtering source is stopped after the thickness of the film has achieved a value just smaller than a targeted film thickness, and then the rapid film deposition is changed to slow film deposition only by use of a magnetron sputtering source with a target mounted on a single magnetron unit to perform the film deposition up to achievement of the targeted film thickness.

4. The sputtering apparatus according to Claim 3, wherein the controller makes such a control that the thickness of the film is monitored by the film thickness measuring instrument during slow film deposition, and that when it is detected that the thickness of the film has achieved the targeted film thickness, the film deposition by the magnetron sputtering source with a target mounted on a single magnetron unit is stopped.

5. A carousel-type sputtering apparatus which is configured so that a drum, which is formed in a polygonal

or circular shape in transverse cross-section, is provided so as to be rotatable in a chamber, the drum having substrate holders provided on an outer peripheral surface; and

magnetron sputtering sources are provided inside a chamber wall, each of the magnetron sputtering sources comprising a target and a magnetron unit for holding the target, and the targets being held so as to be parallel with a rotary axis of the drum by the magnetron units;

the sputtering apparatus comprising:

the magnetron sputtering sources including only AC magnetron sputtering sources, each of which has two adjacent targets provided thereon such that an anode/cathode relationship between the two targets is alternately changed by a frequency;

a film thickness measuring instrument, which measures a thickness of a film deposited on a substrate mounted on a substrate holder during film deposition while rotating the drum;

a power supply unit, which supplies the respective targets with power required for sputtering; and

a controller, which controls parameters affecting on an amount of film deposition, based on measurement results obtained by the film thickness measuring instrument.

6. The sputtering apparatus according to Claim 1, wherein the magnetron sputtering sources are a

combination of a magnetron sputtering source for mounting a target for deposition of a low refractive index film, and a magnetron sputtering source for mounting a target for deposition of a high refractive index film.

7. The sputtering apparatus according to Claim 1, wherein the film thickness measuring instrument comprises a light emitter for radiating measuring light onto a substrate and a light receiver for receiving transmitted light or reflected light of the measuring light radiated onto the substrate to generate an electrical signal in response to a receiving amount of the transmitted light or the reflected light, wherein while the drum is rotated, the measuring light is radiated onto the substrate from the light emitter to measure the film thickness.

8. The sputtering apparatus according to Claim 7, further comprising a calculating means for finding transmittance information or reflectance information based on the signal output from the light receiver.

9. The sputtering apparatus according to Claim 8, wherein the calculating means finds the transmittance information or the reflectance information in response to the incident angles based on signals obtained from the light receiver when incident angle of the measuring light is 0 deg and when the incident angle is in an angular range in the vicinity thereof, thereby to acquire data showing a relationship between the incident angle and transmittance or reflectance.

10. The sputtering apparatus according to Claim 1, wherein the film thickness measuring instrument comprises a light emitter capable of selectively radiating a plural kinds of measuring light having different wavelengths onto the substrate, and a light receiver for receiving transmitted light or reflected light of the measuring light radiated onto the substrate to generate an electrical signal in response to a receiving amount of the transmitted light or the reflected light, wherein while the drum is rotated, the measuring light is radiated onto the substrate from the light emitter to measure the thickness.

11. The sputtering apparatus according to Claim 10, further comprising a calculating means for finding transmittance information or reflectance information for the plural kinds of measuring light having different wavelengths based on the signal output from the light receiver.

12. The sputtering apparatus according to Claim 11, wherein the calculating means finds transmittance or reflectance for the plural kinds of measuring light having different wavelengths, in response to incident angles based on signals obtained from the light receiver when incident angle of the measuring light is 0 deg and when the incident angle is in an angular range in the vicinity thereof, thereby to acquire data showing a relationship between the incident angle and transmittance

or reflectance.

13. The sputtering apparatus according to Claim 9, wherein the calculating means makes approximate conversion based on data showing the relationship between the incident angle and the transmittance or the reflectance to find spectral transmittance or spectral reflectance.

14. The sputtering apparatus according to Claim 7, wherein the film thickness measuring instrument is provided at a position far from the magnetron sputtering sources.

15. The sputtering apparatus according to Claim 7, wherein a light-shielding pipe is provided between an inner wall of the chamber and the substrate holders so as to encircle a light path where the transmitted light or the reflected light of the measuring light is passing.

16. The sputtering apparatus according to Claim 15, wherein the light-shielding pipe is electrically insulated from the chamber.

17. The sputtering apparatus according to Claim 15, wherein the light-shielding pipe has a leading edge provided with a reflection preventing member for reducing multiple reflection between the substrates and the leading edge.

18. A sputtering apparatus comprising:

AC magnetron sputtering sources, each having two adjacent targets provided thereon such that an

anode/cathode relationship between the two targets is alternately changed by a frequency;

magnetron sputtering sources with a target mounted on a single magnetron unit; and

a controller, which makes such a control that rapid film deposition is performed by an AC magnetron sputtering source from start of film deposition, the film deposition by the AC magnetron sputtering source is stopped after the thickness of the film has achieved a value just smaller than a targeted film thickness, and then the rapid film deposition is changed to slow film deposition only by use of a magnetron sputtering source with a target mounted on a single magnetron unit to perform the film deposition up to achievement of the targeted film thickness.

19. The sputtering apparatus according to Claim 1, wherein the target has a target surface inclined at such an inclination angle that when the target is located in a positional relationship to confront the substrate, the target surface is prevented from being parallel with a surface of the substrate.

20. A sputter film deposition method using a carousel-type sputtering apparatus which is configured so that a drum, which is formed in a polygonal or circular shape in transverse cross-section, is provided so as to be rotatable in a chamber, the drum having substrate holders provided on an outer peripheral surface; magnetron

sputtering sources are provided inside a chamber wall; each of the magnetron sputtering sources comprises a target and a magnetron unit for holding the target; and the targets are held so as to be parallel with a rotary axis of the drum by the magnetron units;

the method comprising:

measuring a thickness of a film deposited on a substrate mounted on a substrate holder during film deposition; and

controlling parameters affecting on an amount of film deposition, based on measurement results obtained by the film thickness measuring step.

21. A sputter film deposition method using a sputtering apparatus which comprises AC magnetron sputtering sources, each having two adjacent targets provided thereon such that an anode/cathode relationship between the two targets is alternately changed by a frequency, and magnetron sputtering sources with a target mounted on a single magnetron unit;

the method comprising performing rapid film deposition by use of an AC magnetron sputtering source from start of film deposition, stopping the film deposition by the AC magnetron sputtering source after the thickness of the film has achieved a value just smaller than a targeted film thickness, and then changing the rapid film deposition to slow film deposition only by use of a magnetron sputtering source with a target

mounted on a single magnetron unit to perform the film deposition up to achievement of the targeted film thickness.

22. The method according to Claim 21, further comprising measuring a film thickness during film deposition; and controlling parameters affecting on an amount of film deposition based on measurement results obtained by the film thickness measuring step.

23. A sputter film deposition method using a carousel-type sputtering apparatus which is configured so that a drum, which is formed in a polygonal or circular shape in transverse cross-section, is provided so as to be rotatable in a chamber, the drum having substrate holders provided on an outer peripheral surface; and magnetron sputtering sources are provided inside a chamber wall, each of the magnetron sputtering sources comprising a target and a magnetron unit for holding the target, and the targets being held so as to be parallel with a rotary axis of the drum by the magnetron units;

the method comprising:

using, as the magnetron sputtering sources, only AC magnetron sputtering sources, each of which has two adjacent targets provided thereon such that an anode/cathode relationship between the two targets is alternately changed by a frequency, and depositing a film on a substrate mounted on a substrate holder while rotating the drum;

measuring a thickness of the film deposited on the substrate mounted on the substrate holder during film deposition while rotating the drum; and

controlling parameters affecting on an amount of film deposition based on measurement results obtained by the film thickness measuring step.

24. The method according to Claim 20, further comprises radiating measuring light onto the substrate while rotating the drum; and receiving transmitted light or reflected light of the measuring light radiated onto the substrate to generate an electrical signal in response to a receiving amount of the transmitted light or the reflected light.

25. The method according to Claim 24, further comprising calculating transmittance information or reflectance information based on the signal output from the light receiving step.

26. The method according to Claim 25, wherein the calculating step comprising finding transmittance or reflectance in response to the incident angles based on signals obtained from the light receiver when incident angle of the measuring light is 0 deg and when the incident angle is in an angular range in the vicinity thereof, thereby to acquire data showing a relationship between the incident angle and the transmittance or the reflectance.

27. The method according to Claim 20, wherein the film

thickness measuring step comprises selectively radiating a plural kinds of measuring light having different wavelengths onto the substrate while rotating the drum; and receiving transmitted light or reflected light of the measuring light radiated onto the substrate to generate an electrical signal in response to a receiving amount of the transmitted light or the reflected light.

28. The method according to Claim 27, further comprising calculating transmittance or reflectance for the plural kinds of measuring light having different wavelengths based on the signal obtained in the light receiving step.

29. The method according to Claim 28, wherein the calculating step comprising finding the transmittance or the reflectance for the plural kinds of measuring light having different wavelengths, in response to incident angles based on signals obtained from the light receiver when incident angle of the measuring light is 0 deg when the incident angle is in an angular range in the vicinity thereof, thereby to acquire data showing a relationship between the incident angle and the transmittance or reflectance.

30. The method according to Claim 26, wherein the calculating step comprises making approximate conversion based on the relationship between the incident angle and the transmittance or the reflectance to find spectral transmittance or spectral reflectance.

31. The method according to Claim 20, wherein the film

thickness is measured at a position far from the magnetron units so as to minimize an adverse effect by plasma light generated in the magnetron units.

32. The method according to Claim 24, further reducing adverse effect by unnecessary light from outside by encircling by a light-shielding pipe a light path where the transmitted light or the reflected light of the measuring light is passing.

33. The method according to Claim 20, wherein using a target, which has a target surface inclined such that when the target is located in a positional relationship to confront the substrate, the target surface is prevented from being parallel with a surface of the substrate.